

# Progress Report on the Dual-Use Cryostat

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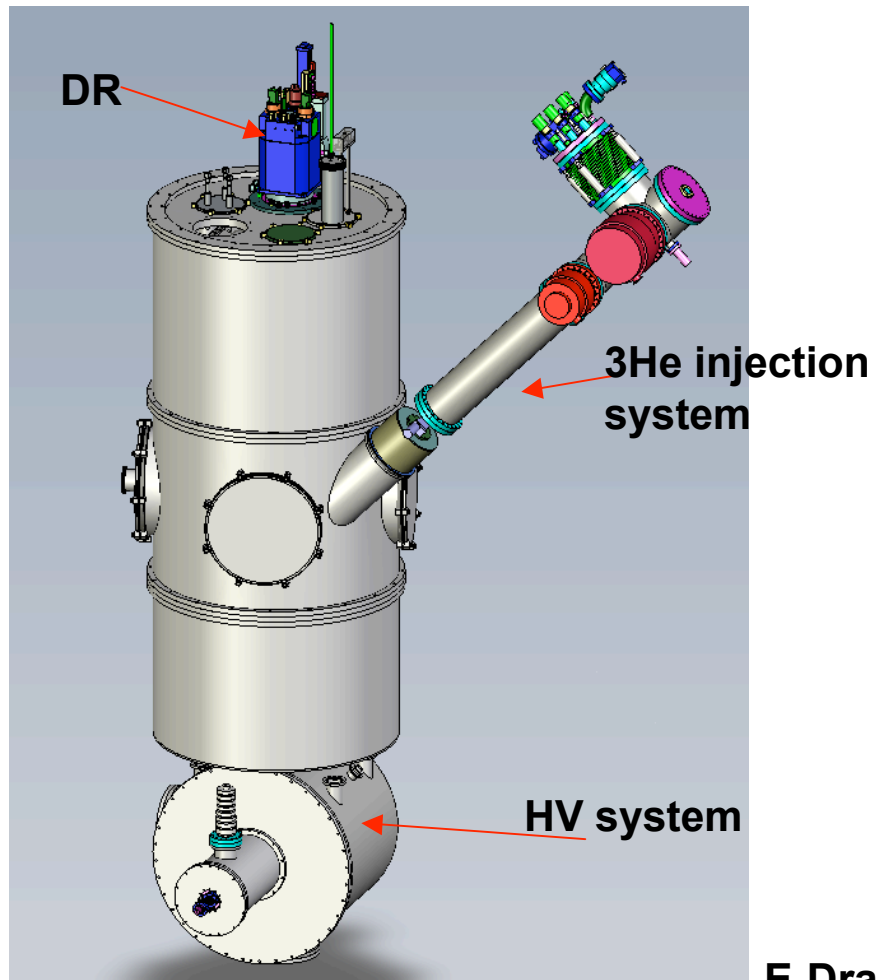
J. Long  
*Indiana University*

X. Zhu  
*Duke University*

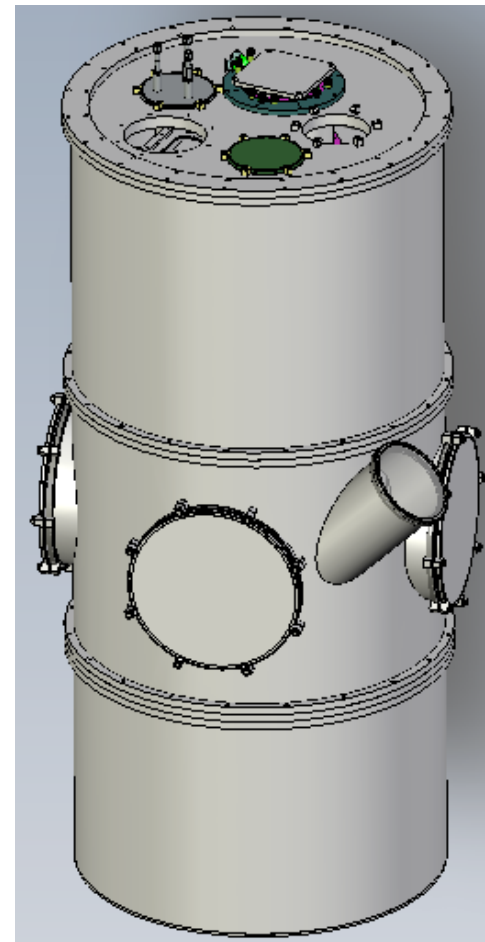
EDM collaboration meeting  
Feb. 09, 2008

# Dual-Use Cryostat (overview)

Full assembly (DR, HV, 3He)

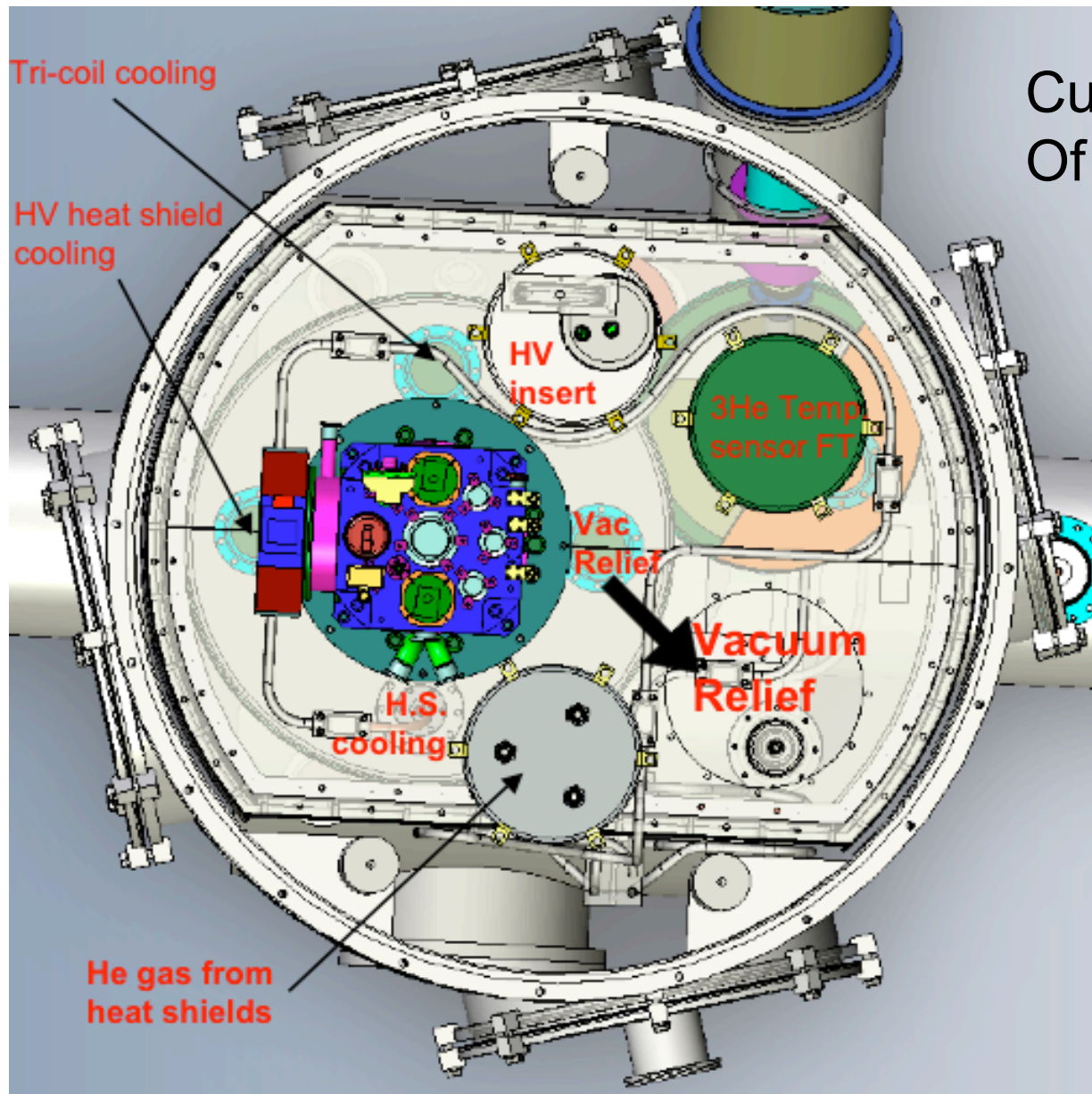


(during cooling test without DR)



E-Drawing files courtesy of John Ramsey

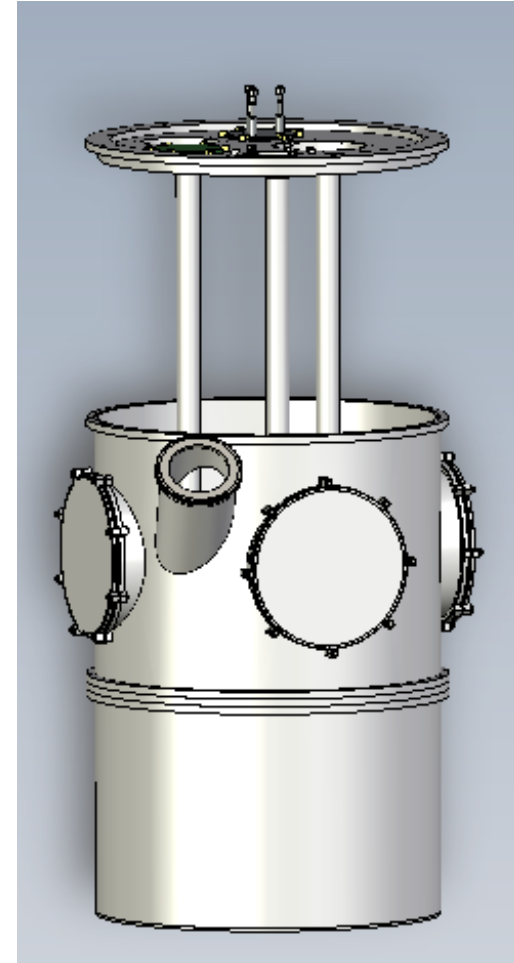
# Cryostat top view



Current design  
Of the cryostat

# Work on outer vacuum chamber

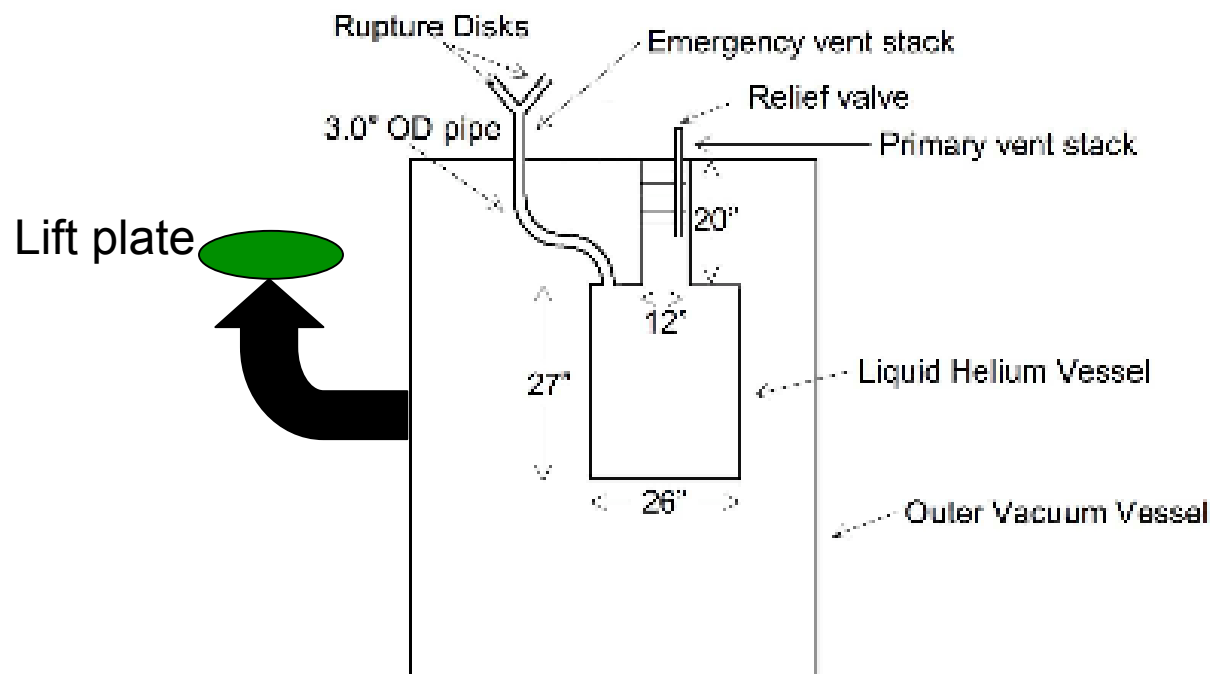
- Many problems on vacuum chamber were found and fixed. [T. Womack]
- After our leak detector was repaired in Nov 2007, we found more leaks from the outer chamber. Leak locations: **side, top, and bottom flanges.**
- Found leaks from side flanges after flange welds were grinded down. We ship the chamber to a machine shop total three times for re-welding but the leaks were never fixed. We then turn down the top plate diameter by 3/8" to avoid grinding down welds. Leaks finally fixed.



# Work on outer vacuum chamber (cont.)

- Found leaks from top flanges. Polished the sealing surface to fix the leaks.
- Leak from bottom flange fixed after making more bolt holes on the flange.
- Installed heli coils on the middle support adapter ring
- Finally, the vacuum level  $2 \times 10^{-5}$  Torr was achieved.
- Installing four clock clumps on top plate (for helium dewar) [in progress]
- Plan to test assembling the dewar to the top plate and do leak check.

# Pressure relief systems for helium dewar and vacuum chamber

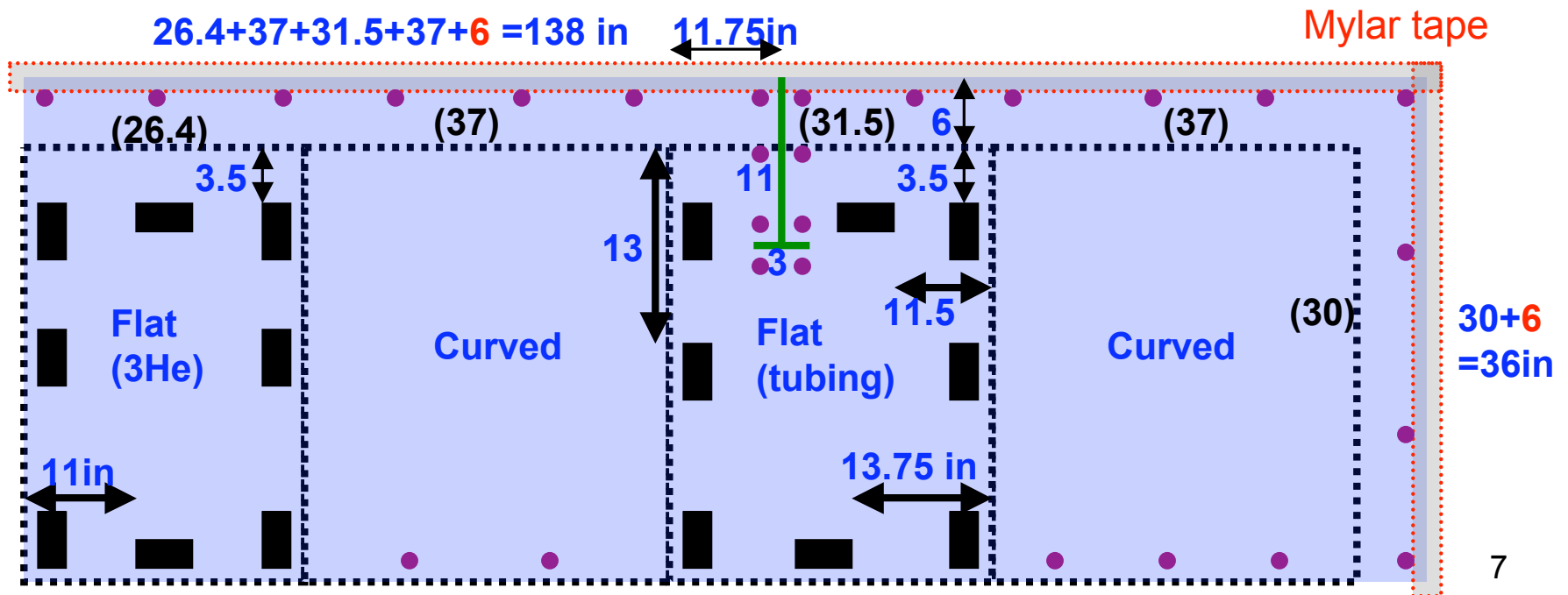


Schematic made by T. Ito

# MLI Blanket assembly

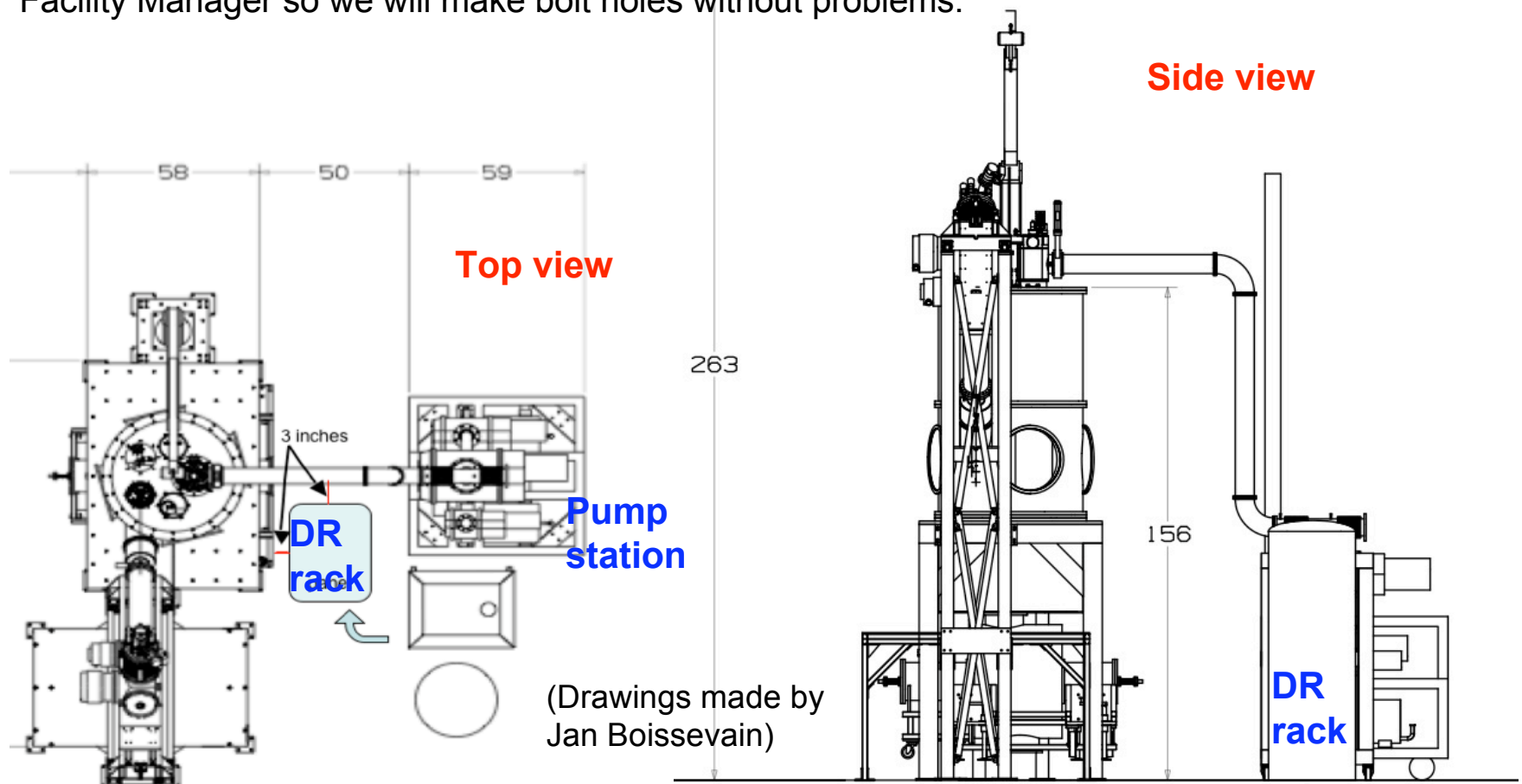
1. Consists of 30 layers of double-aluminized mylar [0.25mil thick] and spacer (spunbonded polyester [4mil thick]) as well as 2mil thick Mylar cover sheets
2. Blanket assembly instructions have been updated (S.Tajima)
3. Use Velcro fasteners and Mylar tapes
4. Blanket assembly nearly finished (X. Zhu and S. Tajima)
5. Black dotted lines: heat shield panel, Blue: MLI blanket, Purple: tag pins

### Example: Blanket design for 50k shield bottom panels



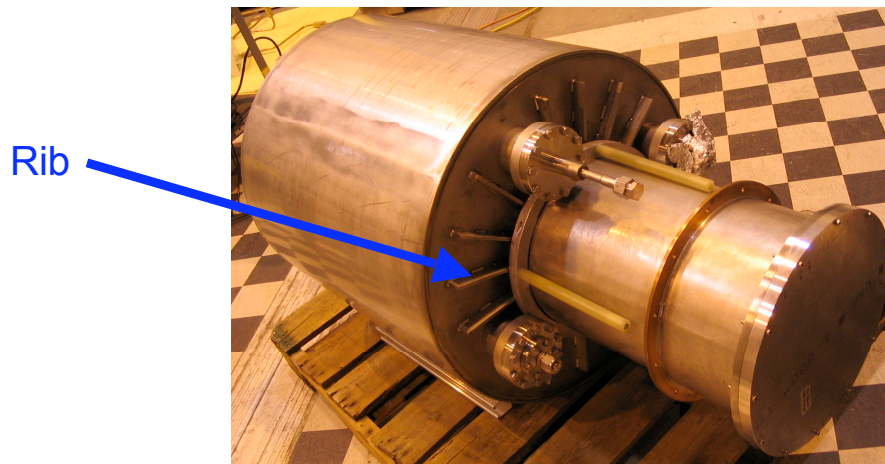
# Experiment area (Bldg 10 at LANL)

- Pump station, DR rack, and 600 liter tank for DR have been moved to the locations specified.
- Need to make 64 bolt holes for the platforms.
- Ground Penetration Radar survey done (Feb. 6) and they found a lot of areas on the floor where we can't make bolt holes. But we obtained a permission from the Facility Manager so we will make bolt holes without problems.



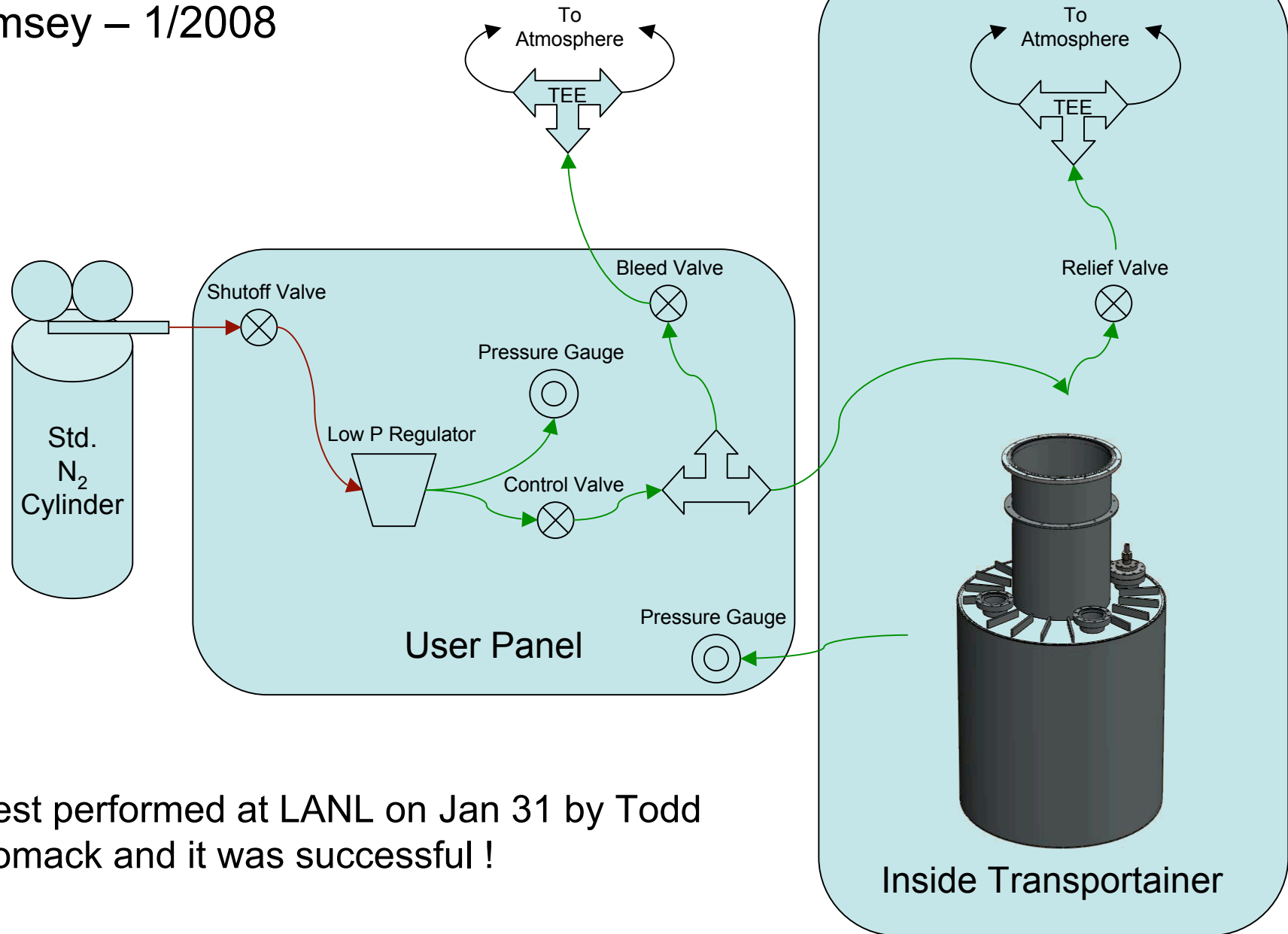
# LHe dewar pressure test

- **Concern:** the weld joints of the dewar ribs may result in high stress values.
- Decided to perform the dewar pressure test at 1 atm (Note that the strength of 304 stainless steel doubles at low temperature).
- Dewar filled with N<sub>2</sub> gas at 15 psi for 30 min to see if there was any leakage or unacceptable deformation.



# Dewar Pressure Test Schematic

Ramsey – 1/2008



- Test performed at LANL on Jan 31 by Todd Womack and it was successful !

# Documentation

1. Dual-use cryostat design document for cooling tests (with or without DR) is being prepared [T. Ito, Jan Boissevain, M. Cooper, and S.Tajima] (still in progress) It contains:
  1. Description of the apparatus
  2. Safety considerations
  3. Operating procedures
  4. Strength calculations
2. Integrated Work Document (IWD) required at LANL
3. Cryostat Installation procedures for cooling tests [S. Tajima]
  - procedures without DR (nearly done)
  - Procedures with DR

# Preparing for R&D

- Two visitors visited LANL for 1 month recently to prepare for R&D
- J. Long (Indiana Univ) worked on HV system (assembly and installation of 4k heat shield)
- X. Zhu (Duke Univ) is visiting LANL to work on MLI Blanket assembly and  $^3\text{He}$  injection system (incl. safety document) as well as taking LANL trainings.

# List of things to do / Timeline

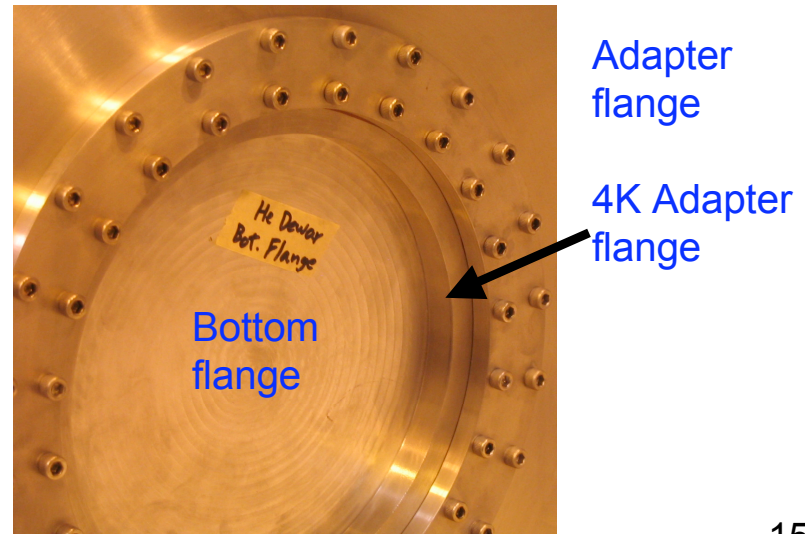
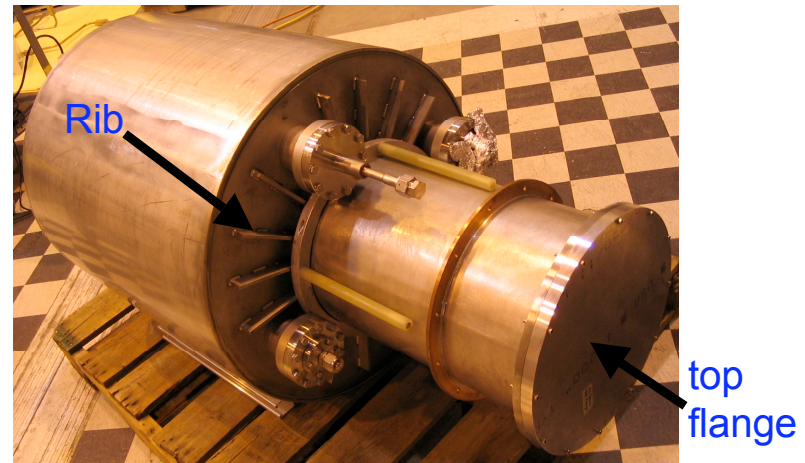
1. LHe dewar leak check [1 week or more] (done in Nov, 2007)
2. LHe dewar pressure test (done 1/31)
3. Modifying parts for Cryostat and do leak check (nearly done)
4. Temperature sensor wiring and testing [2 weeks]
5. Making MLI Blankets [1 week] (nearly done)
6. Finish documents on safety, installation, and operations (in progress)
7. Glue velcro and temperature sensors on heat shield panels (1 week)
8. Order parts for cryostat (transfer line, rupture disks, lift plate) (a few weeks)
9. (Making 64 bolt holes on the floor of Bldg10 at LANL.)
10. Set up Labview for cooling tests [3 weeks ?]
  
11. Assemble the whole cryostat and do leak check [2 weeks or more]
12. Cooling test (without DR, HV, 3He installed) [1 week or more]
13. Install DR into the cryostat and perform cooling test (without HV and 3He installed) [3 weeks or more]
14. Install HV system and perform R&D
15. Install 3He system and perform R&D

# Summary

- Still continue working on vacuum chamber but we have fixed many problems and leaks. We are preparing for cooling tests.
- Work delays happen due to unforeseen events.
- Important to finish the cryostat work as soon as possible because HV and  $^3\text{He}$  R&D need to be done.

# Liquid Helium Dewar

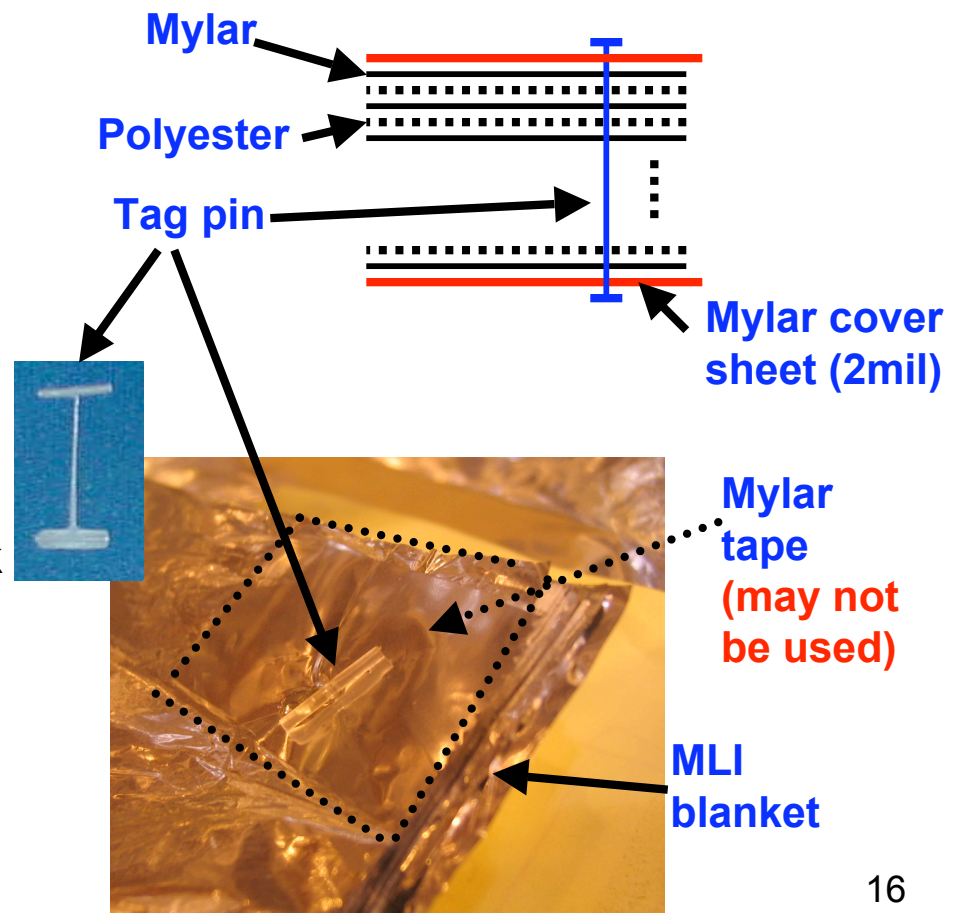
- Important to make sure that the LHe dewar is leak tight BEFORE installation into the cryostat (Put blank-off flanges on top and bottom)
- some design modifications were needed
- Bottom flange was designed for 5-mil thick kapton but it did not seal. Sealing surface polished but it's ~8mil polish
- Decided to use Indium wire instead of kapton. The grooves for 32-mil Indium were made on the flange.
- Four conflat ports (leak check needed) are for
  - Cooling cryostat heat shields
  - Cooling HV heat shields
  - Vacuum relief
  - Cooling 3He tri coil
- Ribs added to the dewar top plate to add strength to it (leak check needed)



# Multi Layer Insulation (MLI) Blanket

- MLI blanket manufactured at Cad Cut Inc.
- Consists of 30 layers of double-aluminized mylar [0.25mil thick] and spacer (spunbonded polyester [4mil thick] by Reemay)
- Mylar sheets perforated with 0.1in diameter holes, spaced 2in apart
- Use tag pins (made of nylon) to secure the blanket layers.
- Tag pin: 0.5in long, blanket: ~0.3in thick
- Blankets to be installed around 50k heat shield, LHe dewar, and tri coil

Tag gun



# Heat Shields

Cooling blocks and pipes are attached to heat shields  
50k shield, 4k shield (inside) and Helium dewar (shown in green)

